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# ETHICAL BEHAVIORS IN E-TENDERING PROCESS FOR CONSTRUCTION PROJECT IN MALAYSIA

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**ABSTRACT**

Nowadays, application of electronic commerce is increasing in commercial fields; this includes procurement process which introduced e-Tendering in construction industry. e-Tendering concept is to engage lesser paperwork and provide higher transparency in every transaction of procurement process. The aim of this paper is to study ethical issues related e-Tendering in Malaysia construction industry. This paper reviewed previous and recent literature in order to identify the ethical issues and risk of corruption encountered in electronic commerce. Questionnaire survey was used to identify the current situation of e-Tendering involving ethical issues and factors that contributed to these issues. This study proposed potential initiatives to resolve the issues of procurement transparency that improve ethical behavior of parties in managing and bidding tender. This study utilized Average Index method and ideal solution (TOPSIS) for data analysis. TOPSIS which is one of the multi-criteria decision making methods for ranking the factors contributed to ethical issue in e-tendering and the potential initiatives for improvement. Results of TOPSIS showed that the most critical factor that contributed to the ethical issue in e-Tendering was cronyism, followed by lack of meritocracy, collusion, unpublicized process, long-term relationship, human greed and transparency feature of e-Tendering. In addition, from the result, it was concluded that the initiative that was known to be most potential in enhancing e-Tendering process was the features of the e-Tendering system and the ethical awareness among tendering authorities.

**Keywords:** *TOPSIS, Ranking, Ethical behavior, E-Tendering, Procurement process, Construction industry*

## 1. INTRODUCTION

Ethics is an important practice in any business activities. The importance was proven by abundant of literature conducted on implementation of code of ethics in a business environment. The code of ethics is theoretically represented by a person's moral ideals. A person required integrity and courage of convictions in order to comply with the moral ideals, it is not easy to do what you know is "right". Sometimes it is even more difficult to follow the code of ethics that is against your own values [1].

Among all kind of business fields, construction activities are most likely to be conducted by involving personal ethics or individual moral value. As The World Justice Project reported in 2008, construction is cited as one of the most corrupt industries worldwide [2]. The unethical behaviors involve in the procurement process was found to increase cost and reduce fees for contractors during the procedure. All the unethical behaviors are aims to converse organizational benefit to individual benefit, which results in higher cost incurred to the client than that of formal standard and bad quality in most of cases [2].

In order to reduce the unethical practices in construction procurements activities, electronic procurement system is introduced as one of its solutions. Electronic procurement system was introduced in many countries in recent years. It was known to be one of the most successful electronic commerce applications. e-Procurement is a powerful tool as it is able to reduce the transaction cost, lead to better decision making and increase the transparency of the procurement process, which provide a better value in the procurement output [3].

In the year 2000, Electronic Government Flagship of Multimedia Super Corridor (MSC) had implemented e-Procurement, which is also known as e-Perolehan, as one of its project at the Federal Government in Malaysia. MSC aims to accelerate Malaysia's entry into the information Age and

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achieve vision 2020. In 14th September 2005, the Deputy Prime Minister of Malaysia, Dato' Sri Mohd Najib bin Tun Haji Abdul Razak (currently Prime Minister of Malaysia) had proven the success of implementing e-Procurement in Malaysia by saying: "The e-Procurement is an obvious testimony to one of the e-Government; successful implementations of ICT to further enhance public service delivery to public and private entities. The e-Procurement application has enabled Government agencies to procure goods and services electronically in an efficient and transparent manner" [3].

E-Procurement is the conversion of traditional manual procurement processes in the Government machinery to application of electronic procurement on the Internet. It is an end-to-end electronic procurement system that enables Government agencies to procure products and services electronically from both local and international suppliers no matter where they are. It uses Internet technologies to create a virtual trading environment for the Government agencies in the country and suppliers around the world. It also creates an interactive and secure trading environment by using its comprehensive and extensive functionality. In the electronic procurement system, it is equipped with four types of procurement that is Central Contract, Direct Purchase, Quotation and Tender. In Malaysia, electronic procurement was implemented in construction industry by using tender type of procurement. It is known as e-Tendering system.

During June 2011, the Ministry of Works had introduced National e-Tendering System (NeTI) and Procurement Information Management System (PIMS) to all Public Work Department (PWD) headquarters across Malaysia. The implementation of NeTI is intended for tendering PWD's work, which has a value of RM 10 million and above, whereas, PIMS is implemented for the work tender under Mechanical and Electrical works (Aliffuddin, 2013). NeTI is established by joining PWD and Construction Industry Development Board (CIDB), which was developed in order to make sure that Government's acquisitions are handled effectively based on the principle of transparency while all together improving the efficiency of Government's delivery of services. The transparency in public service is proven from the use of e-Tendering where procurement activities are carefully monitored and recorded using Public Key Infrastructure (PKI) technology. For an example, reverse auction bidding concept is used in the process of e-Tendering. This able to promote transparency from the order preparation stage up to the final stage of the order fulfillment in a transparent environment, participated only by qualified suppliers who are registered under the category code for the required tender. This in hand will determine quality in the product or service being received by the Government agencies [3].

The implementation of e-Tendering system is proving that the Government is striving for the improvement in the public service delivery and a model of transparency and accountability. With the improvement of the service and its performance delivered, the people shall benefit and the country shall become a developed and robust nation.

## 2. DEFINITIONS OF ETHICS

The definition of ethics based on Webster's Dictionary is "Conforming to accepted professional standards of conduct" [4], whereas; Encarta's Encyclopedia defined ethics as "A system of moral principles governing the appropriate conduct for an individual or group" [4]. The definition of ethics is also generated by people based on their own thoughts and personal experience on ethics. Ben Maibach, President of Barton Malow believes that when all things appear equal, profitability may depend on good name [4].

Professional ethics is essential and need to be discussed as they affect the decisions and actions of the professionals. Its importance is proven by lots of literature and researches conducted before on how to comply the code of ethics in a business environment [4]. However the procedure of code development and implementation are focused, while less attention has been given to the individuals who must follow the code [5].

There is lots of studies have been conducted previously on the relationship between the code of ethics and individual values by evaluating the emotional reactions of successful construction procurement staff. A code reflects the collective conscious of profession and is testimony to the group's recognition of its moral dimensions [4]. Issues arise whenever there is different acceptance of the collective consciousness. If the code is doubted, the spirit along with the code may be violated [4]. Thereby, determination for the actual feelings on the ethical determinants of code value is essential.

The topics of ethics include the right and responsibilities, quality of life issues, equity and access, the use of power and risk, privacy and copyright issues and how they affect individuals,

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institutions, organizations, cultures, communities, and nations [6]. Nowadays, the gap between the cultures of the scientific and humanities communities are getting widen [7]. The advances of science and technology have developed many of our new moral and social problems, which require some critical thinking and action to solve them. In order to solve these problems, the two cultures need to work together. For the scientific community, they must provide a better technical understanding of the underpinnings of the technologies involved, whereas, the humanities community must bring a principle on making moral judgments and social and political alternatives as well [4].

## 3. ETHICS IN CONSTRUCTIONS INDUSTRY

After understanding the concept of ethics in general term, ethics based on construction industry is crucial to be understood in this study. The term "ethics" was perhaps overused in the 1990s, but notions behind it obviously were not [4]. A survey was conducted in 1997 showed that 56 percent of employees in the construction industry felt with pressure to act unethically or illegally on their job [4]. Nowadays, many of the ethical lapses have caught up to their perpetrators. The tales of corporate malfeasance can be easily found in the internet source. The corporate named Enron, Arthur Andersen, Global Crossing and WorldCom are all examples of greed and dishonesty. However, the environment in construction industry is even more fragile to ethical dilemmas due to its low-price mentality, intense competition and thin profit margin [4].

In construction industry, the professionals involved must always remember the place of code of ethics in the practice in their profession [8]. Construction Managers often remind themselves as someone having the duty to maintain the financial well-being of their company, whereas, engineers are assigned with the engineering codes as a duty to protect the public. The applicability of each role for engineers and managers is a matter of debate.

Construction companies do held the responsibility to the public's safety and health. Every party involved in construction projects must always place their social responsibility over the objectives of organization. For an example, construction managers or engineers should see the important of safety equivalent to the profits, or even safety come before profits. This is because lives are much more precious than cost or benefits. Thereby, cost analysis is not enough when lives are at stake [4].

Professionals are required to avoid themselves from a "microscopic" way of looking at their role within the corporation and look up from their given tasks to see the larger implication of the work they perform for the society [9]. Essentially, Michael Davis mentioned that the problems associated with professional code of ethics are based on the fundamental questions of social obligation. By referring to the Challenger disaster as a case study, although there is no people who against the law in Challenger, there was still a clear mischief by the Morton Thiokol's managers and engineers [4]. For a construction engineer, safety is the paramount consideration. The project managers and engineers could not say the launch would be safe. So, Lund should have delayed the launch [4]. In that case, seven people died, in part at least, because he did not do what, as a project manager or as an engineer, he was supposed to do [9]. In every fields of construction, safety must be prioritized and the most important is that the construction participants are ensuring it. Besides that, there is also another article stating that safety is an especially critical factor for transport engineers and their managers [20]. In highway designation and construction, safety must be considered before cost consideration as it involved of intensive traffic on roads. Carlton argues that increased safety should be the primary goal in engineering design and construction projects. Safety is a social, not a legal obligation [4]. In construction industry, safety is an important element and should be safeguarded by the professional engineering societies. It is imperative that individual professional adhere to what their society mandates. Before construction managers and engineers make any designs and management decisions, the responsibility to the public welfare must always be held at the first place. Besides, construction quality in engineering is necessary, which means that there is a demand for ethical corporate practice and creative engineering. Therefore professional ethics must comply with the engineers knowledge in the practices of planning, design and construction, thus it ensure safety, benefits and profit to the parties involves in project development. The entire construction profession benefits when every participant in the construction takes the responsibility for every work involved. Ethical engineering practices are known to provide positive effects towards engineering creativity and public relations.

When ones thinking like a professional, the code of ethics must be remembered in the professional practice. On the other hand, project managers and engineers should not only comply to the

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professional code of ethics, but should also be supporting it indirectly by encouraging others to do as it requires and by criticizing, ostracizing, or otherwise calling to account those who do not [10]. Michael Davis stated that there are four reasons for the professionals to support their professions code. First of all, professionals in construction industry should support their professions code because supporting it will help protect them and those they care about from being injured. Second, by supporting the code, it will also help assure a working environment in which it will be easier than it would otherwise be to resist pressures to do much. Thirdly, professions code should be supported because it helps make their profession a practice of what they need not feel morally justified embarrassment, shame, or guilt. For the fourth reason, one has an obligation of fairness to do his part insofar as he claims to be a professional and other professionals are doing their part in generating these benefits for the entire construction industry [8].

Moreover, there is also research conducted based on empirical investigation, which the attitudes and behavioral intent towards collusive tendering of key individuals in the construction tendering process [11]. This study also identifies the factors contributed to these attitudes. The finding for this research study is that minority of the candidates, who involved in decision making, admit that they would consider participating in a collusive tendering process agreement under certain circumstances.

The research interest in ethics related to the construction industry is increasing gradually. This interest has focused on the introduction, examination and application of applied professional ethics as it relates to construction training program. This has been spurred, at least in part, by the liability insurance crisis, a product of both the bad publicity given the industry in bid-rigging cases (some of which have been given prominent media coverage), and increased public interest in issues of environmental impact and safety. Besides that, there are other factors, which include the incremented rate for litigation and skyrocketing awards given plaintiffs by the courts [4]. In this society, high standards of professional competence and performance were demanded. Constructors are aware of their social responsibilities and they had prepared to reflect critically on the moral dilemmas that they are facing. They are fulfilling their parts in moral obligations to the public. The public obtains an understanding of the extent and limit of the constructors' responsibilities. Therefore, there are several bodies were formed regulate the professional conduct and practice of registered engineers in order to safeguard the safety and interest of the public.

## A. *Research Lead*

The main purpose for e-Tendering application is to provide a better paperless and transparent procurement. The attention is avoiding corruption in procurement process. In addition, the results of the e-Tendering system were found to be influenced by users' ethical behaviors. Corruption in construction is known to occur due to human's behavior and it tends to be reduced by the transparency features of the e-Tendering system. Thus, the theory of the features in e-Tendering system leads to several questions based on the ethical issue in realistic situation and sparked questions to investigate a) What are the existing problems that involve ethics in construction procurement through the e-Tendering process? b) What are the factors involved in the process of e-Tendering regarding to ethical problems? c) What are the possible ways that can be implied in e-Tendering process to reduce the possibilities of unethical behavior involved?. These research questions lead to the following aim and objectives of the study.

This study aims to investigate ethical issues related to the construction procurement process through the use of e-Tendering in Malaysia. In order to achieve the aforementioned aim, several objectives were identified and the objectives were:

i. To determine the real situations of the construction procurement through e-Tendering where ethical problems involved.

ii. To identify and rank the factors contributed towards unethical behaviors by the users throughout the process of procurement with the use of e-Tendering system.

iii. To propose potential initiatives to improve the quality of the results for the procurement through e-Tendering system and find their importance level.

This study is important in order to determine the current issue for the e-Tendering system that is utilized by the users with different kinds of personal qualities in the construction industry in Malaysia. Furthermore, the study can provide the awareness and knowledge on developing positive ethics

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towards the improvement of e-Tendering in the Government context.

The scope of study includes the followings:

i. The study will only focus on the ethical issues involved in e-Tendering process.

ii. This study only deals with the existing situation of the e-Tendering process and the factors contributed to ethical issue.

iii. The respondent for questionnaire survey only involve Grade 7 contractor in Johor Region of Malaysia.

iv. The initiatives proposed only based on the findings from the questionnaire survey.

## B. Data Collection

In this study, quantitative techniques were applied in the data collection in order to achieve the objectives of this study. The targeted respondent for the questionnaire survey was confined to the Grade 7 contractors that are recognized by the Construction Industry Development Board (CIDB) ranking. In order to support the quantitative data, qualitative data was collected through interview session with the professionals, who have experiences in e-Tendering process.

Questionnaire survey was selected due to the fact that it is an easy and inexpensive method in gathering large amount of data from the respondents. The questions were designed based on the literature review and were aimed to achieve the objectives of the study. Furthermore, the data analysis for the questionnaire is easy to carry out. The targeted respondents for data collection were construction professional who have sufficient knowledge and experience on the subject of the study. According to the data provided by the respondents, conclusions were drawn.

A total of 120 sets of questionnaire surveys were distributed among the targeted respondents. The analysis and discussions of the results were divided into 3 parts. Part 1 of the questionnaire survey consists of 17 questions that identify the existing situation of the e-Tendering related to ethical issue. Part 2 of the questionnaire survey composed of 17 questions related to factors that contributed to ethical issue in e-Tendering. Part 3 of the questionnaire survey designed with 9 questions in proposing potential initiatives for e-Tendering enhancement.

All the data gathered were analyzed with Statistical Package for the Social Sciences (SPSS) version 16 and TOPSIS technique. Average index of the data were computed to identify variables that are applicable in this study. In addition, the TOPSIS technique is applied for ranking the factors contributed to ethical issue in e-tendering and the potential initiatives for improvement in the Part 2 and Part 3 of questionnaire survey. From the data gathered, the existing situation of e-Tendering regarding ethical issue was identified. The objectives to determine the factors contributed to ethical issue in e-Tendering were attained. Based on the data from questionnaire survey, potential initiatives had been made for the enhancement on e-Tendering.

## C. Average Index

Average Index (AI) was used in measuring the average value of the data gathered from the questionnaire. It is a measure that typifies a set of observation data into a single value. The range of the value was tabulated in Table 1. AI is applied in this study to determine the significance of each variable from the view of respondents. The calculation for AI is based on the equation as stated below:

$$\textbf{Average Index} = \frac{\sum a_i x_i}{\sum x_i} \quad (1)$$

Where:

$a_i$ = constant expressing the weight given to $i$

$x_i$ = number of response for $i$ = 1, 2, 3, 4, 5

$x_1$ = number of respondents who answered "Strongly Disagree"

$x_2$ = number of respondents who answered "Disagree"

$x_3$ = number of respondents who answered "Neutral"

$x_4$ = number of respondents who answered "Agree"

$x_5$ = number of respondents who answered "Strongly Agree"

The method of averaging individual rating to a discrete value or index is easy, but extra care is required during its analysis and interpretation of these values so that they reflect the overall respondents rating.

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**Table 1.** Range for Average Index.

| Likert Scale | Range |
|---|---|
| 1 = Strongly Disagree | (1.00 ≤ Average Index < 1.50) |
| 2 = Disagree | (1.50 ≤ Average Index < 2.50) |
| 3 = Neutral | (2.50 ≤ Average Index < 3.50 |
| 4 = Agree | (3.50 ≤ Average Index < 4.50) |
| 5 = Strongly Agree | (4.50 ≤ Average Index ≤ 5.00) |

## 4. TOPSIS TECHNIQUE

TOPSIS, one of the known classical Multi-Criteria Decision Making (MCDM) methods [21,22], was first developed by [12] that can be used with both normal numbers and fuzzy numbers. TOPSIS makes full use of attribute information, provides a cardinal ranking of alternatives, and does not require attribute preferences to be independent. To apply this technique, attribute values must be numeric, monotonically increasing or decreasing, and have commensurable units [18]. The procedure of the TOPSIS method consists of the following steps:

Given a set of alternatives, $A = \{A_i \mid i = 1,\cdots,n\}$, and a set of criteria, $C = \{C_j \mid j = 1,\cdots,m\}$, where $\tilde{X} = \{\tilde{x}_{ij} \mid i = 1,\cdots,n; j = 1,\cdots,m\}$ denotes the set of fuzzy ratings and $\tilde{W} = \{\tilde{w}_j \mid j = 1,\cdots,m\}$ is the set of fuzzy weights. The first step of TOPSIS is to calculate normalized ratings by

$$\tilde{r}_{ij}(\boldsymbol{x}) = \frac{\tilde{x}_{ij}}{\sqrt{\sum_{i=1}^{n} \tilde{x}_{ij}^2}}, \quad i = 1,\cdots,n; \quad j = 1,\cdots,m \tag{2}$$

and then to calculate the weighted normalized ratings by

$$\tilde{v}_{ij}(\boldsymbol{x}) = \tilde{w}_j \tilde{r}_{ij}(\boldsymbol{x}), \quad i = 1,\cdots,n; \quad j = 1,\cdots,m. \tag{3}$$

Next the Positive Ideal Point (PIS) and the Negative Ideal Point (NIS) are derived as

$$PIS = \tilde{A}^+ = \{\tilde{v}_1^+(\boldsymbol{x}), \tilde{v}_2^+(\boldsymbol{x}), \cdots, \tilde{v}_j^+(\boldsymbol{x}), \cdots, \tilde{v}_m^+(\boldsymbol{x})\} \tag{4}$$

$$= \{(\max_i \tilde{v}_{ij}(\boldsymbol{x}) \mid j \in J_1), (\min_i \tilde{v}_{ij}(\boldsymbol{x}) \mid j \in J_2) \mid i = 1,\cdots,n\}$$

$$NIS = \tilde{A}^- = \{\tilde{v}_1^-(\boldsymbol{x}), \tilde{v}_2^-(\boldsymbol{x}), \cdots, \tilde{v}_j^-(\boldsymbol{x}), \cdots, \tilde{v}_m^-(\boldsymbol{x})\}$$
$$= \{(\min_i \tilde{v}_{ij}(\boldsymbol{x}) \mid j \in J_1), (\max_i \tilde{v}_{ij}(\boldsymbol{x}) \mid j \in J_2) \mid i = 1,\cdots,n\}. \tag{5}$$

Similar to the crisp situation, the following step is to calculate the separation from the PIS and the NIS between the alternatives. The separation values can also be measured using the Euclidean distance given as:

$$\tilde{S}_i^+ = \sqrt{\sum_{j=1}^{m} [\tilde{v}_{ij}(\boldsymbol{x}) - \tilde{v}_j^+(\boldsymbol{x})]^2}, i = 1,\cdots,n. \tag{6}$$

.

And

$$\tilde{S}_i^- = \sqrt{\sum_{j=1}^{m} [\tilde{v}_{ij}(\boldsymbol{x}) - \tilde{v}_j^-(\boldsymbol{x})]^2}, i = 1,\cdots,n \tag{7}$$

.

where

$$\max\{\tilde{v}_{ij}(\boldsymbol{x})\} - \tilde{v}_j^+(\boldsymbol{x}) = \min\{\tilde{v}_{ij}(\boldsymbol{x})\} - \tilde{v}_j^-(\boldsymbol{x}) = 0. \tag{8}$$

.

Calculate the relative closeness to the ideal solution. The relative closeness of the alternative $S_i$ with respect to $S^+$ is defined as

$$T_i^* = D(S_i^-) \Big/ [D(S_i^+) + D(S_i^-)], \quad i = 1,\cdots,n \tag{9}$$

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Rank the preference order. The larger the value of $T_i$, the better the alternative $S_i$. The best alternative is the one with the greatest relative closeness to the ideal solution. Alternatives can be ranked in decreasing order using this index.

### A. Ascertaining the entropy weight vector

Information entropy is an uncertainty measure in information theory. Using the entropy method, objective weights are calculated. Objective weights of the objective ratios can be determined by Shannon's entropy concept found by [15]. In this research, the concept of entropy is applied to determine the criteria weight. According to [16], entropy is a term in information theory, also known as the average amount of information. The criteria weights are calculated by the entropy method. According to the degree of index dispersion, the weight of all indicators is calculated by information entropy. Entropy method is highly reliable and can be easily adopted in information measurement [13].

Formally, the entropy method begins with a normalization process using the values of matrix $N = \left(n_{ij}\right)_{n\times m}$ ($n$ alternatives and $m$ indicators) by the following specific formulation [12]:

$$n_{ij} = r_{ij} / \sum_{i=1}^{n} r_{ij} \quad (10)$$

The following equation calculates entropy measure of every index:

$$E_j = -K\sum_{i=1}^{n}\left[n_{ij} ln(n_{ij})\right] \ \forall_j = 1,2,...,m$$
$$K = \frac{1}{ln(n)} \quad (11)$$

The degree of divergence $d_j$ of the intrinsic information for each criterion $C$ (j= 1, 2,…, n) may be calculated as:

$$d_j = 1 - E_j \quad (12)$$

The value $d_j$ represents the inherent contrast intensity of $c_j$. The higher the $d_j$, the more important the criterion $c_j$ is for the problem. The objective weight for each criterion can be obtained. Accordingly, the normalized weights of indexes may be calculated as:

$$W_j = \frac{d_j}{\sum_{k=1}^{m} d_k} \quad (13)$$

Since $E_j$ is less than or equal to one, the entropy weights are therefore always positive.

## 5. RESULTS AND DISCUSSION

In this study, a total of 30 sets of questionnaire survey were returned from the contractors. The response rate of the questionnaire survey was found to be 25%, which is acceptable as the norm of 20 – 30% with most questionnaire surveys in the construction industry [14]. The data collected were analyzed and discussed accordingly to 3 parts of the questionnaire. The result presented was concluded to achieve the objectives of this study.

**Objective 1:** To identify existing situation of e-Tendering in construction procurement process that involved ethical issue.

In the first step, reliability analysis using Cronbach's alpha was conducted in order to measure the internal consistency of the questionnaire. Then, Average Index was applied for existing situation of e-tendering that involved ethical issue. The desired result for the Cronbach's alpha should be equal or more than 0.70 [19]. In the first part of the survey, it was found to provide 0.714, which is more than 0.70. The result was shown in Table 2. This indicates that the questions are reliable as it had fulfilled the desired criteria of Cronbach's Alpha. Thus, the data collected for 17 questions in the first part of the questionnaire was known to be reliable.

***Table 2.*** *Reliability analysis for existing situation of e-tendering that involved ethical issue*

| Reliability Statistics | | |
|---|---|---|
| Cronbach's Alpha | Cronbach's Alpha Based on Standardized Items | N of Items |
| 0.714 | 0.717 | 17 |

From the result of average index analysis, there are 10 existing situations regarding ethical issue of e-Tendering was agreed by the respondent, whereas, 7 existing situations regarding ethical issue of e-Tendering was disagreed. It was shown in Table 3.

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*Table 3. Average index for existing situation of e-tendering that involved ethical issue.*

| No | Existing Situation | No. of Responses | | | | | Average Index | Status |
|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | | |
| | | | | | | | | |
| A1 | The degree of ethical atmosphere within your organization is low. | 8 | 22 | 0 | 0 | 0 | 1.73 | Disagreed |
| A2 | The level of ethical awareness in the employees of your organization is low. | 6 | 24 | 0 | 0 | 0 | 1.80 | Disagreed |
| A3 | The level of ethical awareness in the top management of your organization is low. | 6 | 24 | 0 | 0 | 0 | 1.80 | Disagreed |
| | | | | | | | | |
| A4 | Ethical issue is sensitive issue in your organization. | 4 | 26 | 0 | 0 | 0 | 1.80 | Disagreed |
| | | | | | | | | |
| A5 | Giving bribe will not contribute long-term profitability of your organization. | 0 | 0 | 0 | 7 | 23 | 4.77 | Agreed |
| A6 | Giving bribe only will contribute in short-term profitability of your organization. | 0 | 0 | 0 | 8 | 22 | 4.73 | Agreed |
| A7 | Unethical behaviors will increase the cost of procurement. | 0 | 0 | 1 | 24 | 5 | 4.13 | Agreed |
| | | | | | | | | |
| A8 | Keeping silent is the solution when unethical behaviors are spotted in your organization. | 5 | 25 | 0 | 0 | 0 | 1.83 | Disagreed |
| A9 | Unethical behavior spotted in your organization need to report to the top management. | 0 | 0 | 0 | 10 | 20 | 4.67 | Agreed |
| A10 | Report to the judiciary bodies when you spotted unethical behavior in the top management. | 0 | 0 | 1 | 24 | 5 | 4.13 | Agreed |
| | | | | | | | | |
| A11 | Unethical behaviors are aimed to obtain profit for own self. | 0 | 0 | 0 | 8 | 22 | 4.73 | Agreed |
| A12 | Organization uses unethical method to obtain profit for the organization's sake. | 1 | 24 | 5 | 0 | 0 | 1.87 | Disagreed |
| A13 | Confidential information in e-Tendering process can be obtained through unethical methods. | 0 | 0 | 25 | 5 | 0 | 3.17 | Disagreed |
| | | | | | | | | |
| A14 | The conditions of the winning bid are not provided in e-Tendering system. | 0 | 0 | 0 | 7 | 23 | 4.77 | Agreed |
| A15 | The report of award proceeding is not provided by e-Tendering. | 0 | 0 | 0 | 23 | 7 | 4.23 | Agreed |
| A16 | The whole process of e-Tendering from acceptance to final processing is not made public on the Internet. | 0 | 0 | 0 | 23 | 7 | 4.23 | Agreed |
| A17 | The application of e-Tendering system is not effective in reducing the occurrence of corruption. | 0 | 0 | 0 | 23 | 7 | 4.23 | Agreed |

From the study and by analyzing the first part survey, it was concluded that the degree of ethical atmosphere within the construction industry in Malaysia was high. Ethical issue was claimed not being a sensitive issue to discuss in an organization. This proved that the level of ethical awareness among the organization is high as they are allowed to bring the matter to the top management if unethical behavior was spotted. Besides that, contribution of unethical behavior was discussed and only short-term profitability will be achieve if an organization applied unethical behavior. Long-

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term profitability only can be achieved by good reputation and performance of an organization. Cost of procurement will increased as unethical behavior involved. The results also showed that the respondents agreed that action should be taken towards anyone who behaves unethically. Unethical behavior was told to obtain profit for personal benefit but not organization benefit and it was unable to obtain confidential information. The e-Tendering system does not provide features that reduce the risk of corruption and it was told that the whole process of the e-Tendering are not publicized for monitoring purpose.

*Table 4. Reliability Analysis For Factors Contributed To Ethical Issue.*

| Reliability Statistics | | |
|---|---|---|
| **Cronbach's Alpha** | **Cronbach's Alpha Based on Standardized Items** | **N of Items** |
| 0.716 | 0.714 | 17 |

Then, TOPSIS is used to rank the factors contributed to ethical issue in e-tendering. Based on 17 parameters, the collected data was used in TOPSIS. Table 5 shows results of respondents' responses categorized by their importance. Following the TOPSIS technique, the ranks of 17 parameters could be obtained with relative weights.

*Table 5. Number Of Responses For Factors Contributed To Ethical Issue.*

| No | Factors | No. of Responses | | | | |
|---|---|---|---|---|---|---|
| | | Not Important | Low Important | Moderate | Important | Very Important |
| Q1 | Transparency feature of e-Tendering system is not efficient in fighting corruption. | 0 | 0 | 2 | 21 | 7 |
| Q2 | Unethical methods are used by an organization to secure the procurement in e-Tendering. | 7 | 22 | 1 | 0 | 0 |
| Q3 | Top management does not support in developing a strong ethical awareness in your organization. | 8 | 21 | 1 | 0 | 0 |
| Q4 | Bribery will influence the results of procurement process in e-Tendering. | 0 | 0 | 0 | 25 | 5 |
| Q5 | The information of the advertisement which showed in the e-Tendering is not sufficient. | 5 | 22 | 3 | 0 | 0 |
| Q6 | Tendering authorities are not able to resist the temptation of unethical incidents. | 0 | 0 | 1 | 23 | 6 |
| Q7 | The bidder, who is related to the tendering authorities have higher opportunity to win a bid. | 0 | 0 | 0 | 20 | 10 |
| Q8 | Reverse auction in e-Tendering system is not providing the lowest bid price. | 0 | 0 | 1 | 21 | 8 |
| Q9 | The competitors will collude to limit competition in procurement by fixing the price. | 0 | 0 | 0 | 23 | 7 |
| Q10 | Senior management encourages unethical behaviors in your organization. | 7 | 23 | 0 | 0 | 0 |
| Q11 | Top management bride tendering authorities to establish and maintain long terms relationships. | 0 | 0 | 1 | 22 | 7 |
| Q12 | E-Tendering system is under the control of the politicians. | 0 | 4 | 24 | 2 | 0 |
| Q13 | Strong political connections are known to be the source of law evasion and consequently corruption in e-Tendering process. | 6 | 21 | 3 | 0 | 0 |
| Q14 | Judiciary bodies are not capable to work freely when comes to politicians. | 7 | 21 | 2 | 0 | 0 |
| Q15 | Reporting corrupted organization to the judiciary body is useless as they have connections with the politician | 6 | 24 | 0 | 0 | 0 |
| Q16 | Every phase in e-Tendering are not publicized for monitoring purpose. | 0 | 0 | 1 | 22 | 7 |
| Q17 | Lack of meritocracy in the e-Tendering administration will be the source of corruption | 0 | 0 | 1 | 21 | 8 |

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Using Eq. (2), results of calculation is presented by Table 6 and Table 7 as follow:

*Table 6. The Result Of Multiplying Each Cell By Itself Of Table 5.*

| Parameter No. | Not Important | Low Important | Moderate | Important | Very Important |
|---|---|---|---|---|---|
| 1 | 0 | 0 | 4 | 441 | 49 |
| 2 | 49 | 484 | 1 | 0 | 0 |
| 3 | 64 | 441 | 1 | 0 | 0 |
| 4 | 0 | 0 | 0 | 625 | 25 |
| 5 | 25 | 484 | 9 | 0 | 0 |
| 6 | 0 | 0 | 1 | 529 | 36 |
| 7 | 0 | 0 | 0 | 400 | 100 |
| 8 | 0 | 0 | 1 | 441 | 64 |
| 9 | 0 | 0 | 0 | 529 | 49 |
| 10 | 49 | 529 | 0 | 0 | 0 |
| 11 | 0 | 0 | 1 | 484 | 49 |
| 12 | 0 | 16 | 529 | 9 | 0 |
| 13 | 0 | 441 | 9 | 36 | 0 |
| 14 | 49 | 441 | 4 | 0 | 0 |
| 15 | 36 | 576 | 0 | 0 | 0 |
| 16 | 0 | 0 | 1 | 529 | 36 |
| 17 | 0 | 0 | 1 | 441 | 64 |
| SUM | 236 | 2836 | 560 | 3494 | 372 |
| SQRT | 15.36 | 53.25 | 23.66 | 59.11 | 19.29 |

*Table 7. Dividing each cell of Table 6 on square of related column (Nd).*

| $n_{ij}$ | | | | |
|---|---|---|---|---|
| Parameter No. | Not Important | Low Important | Moderate | Important |
| 0.00 | 0.00 | 0.17 | 7.46 | 2.54 |
| 3.19 | 9.09 | 0.04 | 0.00 | 0.00 |
| 4.17 | 8.28 | 0.04 | 0.00 | 0.00 |
| 0.00 | 0.00 | 0.00 | 10.57 | 1.30 |
| 1.63 | 9.09 | 0.38 | 0.00 | 0.00 |
| 0.00 | 0.00 | 0.04 | 8.95 | 1.87 |
| 0.00 | 0.00 | 0.00 | 6.77 | 5.18 |
| 0.00 | 0.00 | 0.04 | 7.46 | 3.32 |
| 0.00 | 0.00 | 0.00 | 8.95 | 2.54 |
| 3.19 | 9.93 | 0.00 | 0.00 | 0.00 |
| 0.00 | 0.00 | 0.04 | 8.19 | 2.54 |
| 0.00 | 0.30 | 22.36 | 0.15 | 0.00 |
| 0.00 | 8.28 | 0.38 | 0.61 | 0.00 |
| 3.19 | 8.28 | 0.17 | 0.00 | 0.00 |
| 2.34 | 10.82 | 0.00 | 0.00 | 0.00 |
| 0.00 | 0.00 | 0.04 | 8.95 | 1.87 |
| 0.00 | 0.00 | 0.04 | 7.46 | 3.32 |

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Using the entropy method introduced in Section 4.1, five scales weights were calculated as follows:

$$\sum w_i = 1 \Rightarrow w_1 + w_2 + w_3 + w_4 + w_5 = 0.04601 + 0.05897 + 0.16119 + 0.38872 + 0.34509 = 1$$

Therefore matrix W can be defined as :

$$W = \begin{bmatrix} 0.04601 & 0 & 0 & 0 & 0 \\ 0 & 0.05897 & 0 & 0 & 0 \\ 0 & 0 & 0.16119 & 0 & 0 \\ 0 & 0 & 0 & 0.34509 & 0 \\ 0 & 0 & 0 & 0 & 0.38872 \end{bmatrix}$$

$$V = N_d \times W_{n\times n} = \begin{vmatrix} 0.000 & 0.000 & 0.027 & 2.900 & 0.150 \\ 0.147 & 3.137 & 0.006 & 0.000 & 0.000 \\ 0.192 & 2.857 & 0.006 & 0.000 & 0.000 \\ 0.000 & 0.000 & 0.000 & 4.109 & 0.077 \\ 0.075 & 3.137 & 0.061 & 0.000 & 0.000 \\ 0.000 & 0.000 & 0.006 & 3.479 & 0.110 \\ 0.000 & 0.000 & 0.000 & 2.632 & 0.305 \\ 0.000 & 0.000 & 0.006 & 2.900 & 0.196 \\ 0.000 & 0.000 & 0.000 & 3.479 & 0.150 \\ 0.147 & 3.427 & 0.000 & 0.000 & 0.000 \\ 0.000 & 0.000 & 0.006 & 3.184 & 0.150 \\ 0.000 & 0.104 & 3.604 & 0.058 & 0.000 \\ 0.000 & 2.857 & 0.061 & 0.237 & 0.000 \\ 0.147 & 2.857 & 0.027 & 0.000 & 0.000 \\ 0.108 & 3.734 & 0.000 & 0.000 & 0.000 \\ 0.000 & 0.000 & 0.006 & 3.479 & 0.110 \\ 0.000 & 0.000 & 0.006 & 2.900 & 0.196 \end{vmatrix}$$

From the obtained matrix *V*, positive ideal ( $PIS = \tilde{A}^+$ ) and negative ideal ( $PIS = \tilde{A}^-$ ) are specified in Table 8 as follow.

*Table 8. Positive Ideal ( $PIS = \tilde{A}^+$ ) And Negative Ideal ( $PIS = \tilde{A}^-$ ).*

| Positive Ideal ( $PIS = \tilde{A}^+$ ) | | | | |
|---|---|---|---|---|
| **Max Vi1** | **Max Vi2** | **Max Vi3** | **Max Vi4** | **Max Vi5** |
| 0.192 | 3.734 | 3.604 | 4.109 | 0.305 |
| Negative Ideal ( $PIS = \tilde{A}^-$ ) | | | | |
| **Min Vi1** | **Min Vi2** | **Min Vi3** | **Min Vi4** | **Min Vi5** |
| 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| | | | | |

After calculating the positive ideal and negative ideal of *V* and calculating the $(v_{ij^-} v_{j+})^2$ and $(v_{ij^-} v_{j-})^2$, in the last step, we calculated the weights of all 17 parameters based on the

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similarities to the positive ideal solution as shown in Table 9.

*Table 9. The Final Ranking Of Factors Contributed To Ethical Issue.*

| $\frac{D(S_i^-)}{D(S_i^+)+D(S_i^-)}$ | Parameter No. | Rank |
|---|---|---|
| **0.44252** | **Q7** | **1** |
| **0.44187** | **Q17** | **2** |
| **0.44152** | **Q8** | **3** |
| **0.44152** | **Q9** | **3** |
| **0.40677** | **Q16** | **4** |
| **0.40557** | **Q11** | **5** |
| **0.39998** | **Q6** | **6** |
| **0.39958** | **Q4** | **7** |
| **0.39958** | **Q1** | **7** |
| 0.39954 | Q12 | 8 |
| 0.39815 | Q5 | 9 |
| 0.38482 | Q13 | 10 |
| 0.37674 | Q14 | 11 |
| 0.36334 | Q2 | 12 |
| 0.36334 | Q15 | 12 |
| 0.35328 | Q3 | 13 |
| 0.35328 | Q10 | 13 |
| | | |

From Table 9, the result showed the ranking for all the factors that were known to contribute to ethical issues in e-Tendering. The factor ranked in first place was Q7, which bidder known to have relationship with the tendering authorities have higher opportunity to win a bid. This situation was also known as cronyism. This is an unethical behavior where fair and justice was not practiced by the tendering authorities as the evaluation on the bidding proposal was not done accordingly to meet the criteria of the tender, such as cost proposed, specification provided, and time of completion.

The factor that was ranked in the second place was Q17, which stated that lack of meritocracy in the tendering authorities will be the source of corruption. Corruption occurs when the tendering authority was not chosen according to the talent and basis of achievement. This is because if the tendering authorities were not competent and does not hold the practice of Code of ethic. The bribers maintain long-term relationship with the tendering authorities, who do not hold the Code of ethic, in order to obtained continual award for the procurement. Thus, it was told that lacking of meritocracy system in selecting tendering authorities was the source of corruption.

In the third place of the factor ranking, there were two factors included, which were Q8 and Q9. These two factors can be considered as correlated factors. Q8 stated that reverse auction in e-Tendering system is not able to provide the lowest bid price. This was due to Q9, which stated that the competitors will collude to limit competition in procurement by fixing the price. The relationship for Q8 and Q9 was that the competitors colluded in order to fix the bid price at a certain range and provided that range is not the lowest bid price for the procurement. Collusion was the communication between the competitors in order to achieve an agreement where they will gain benefits for each other by fixing a higher bidding price rather than throwing all out to provide lowest price which cost lower profit margin to the contractors. In this case, reverse auction method was not effective in avoiding unethical behavior to involve in the e-Tendering process.

The factor that was ranked in the fourth place was Q16, which stated that every phase in e-Tendering are not publicized for monitoring purpose. This had proven that transparency feature of e-Tendering was insufficient as the process of the tendering was not able to be monitored. This will lead to corruption as the bidder will not know how the tendering authorities evaluated the proposal submitted by the bidders. Since the process was not publicized, bribery will occurs as the bidder will wish to increase the opportunity to win the procurement.

The factor, Q11, was ranked in fifth place. Q11 stated top management bride tendering authorities

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to establish and maintain long-terms relationships. This factor concerned on the long-term relationship as it was told that achieving this relationship will provides a continual award of such contracts by the procurement officials as they receive benefits from the bidders [17]. Hence, it was concluded that bribery was applied in order to achieve long-term relationship with the tendering authorities.

The following factor was Q16, which was ranked in the sixth place. Q6 stated that the tendering authorities are not able to resist the temptation of unethical incidents. This factor showed that the ethical awareness in the tendering authorities was challenged as it was known not able to resist the temptation of unethical incidents, such as bribery and cronyism. Human greed was a problem that leads to the occurrence of bribery. This was because everyone would like to be rich as money plays important role in daily life. In Chinese quotes, "Money is not everything, but without money nothing can be done". Thus, tendering authorities faced difficulties in resisting the temptation of unethical incidents was known as the sixth important factor.

In the seventh place of the ranking, there were two factors involved, which were Q4 and Q1 as they had the same mean ranking. These two factors was known to be correlated as the occurrence of bribery in order to influence the results of procurement process in e-Tendering was due to the ineffectiveness of the transparency feature possessed by e-Tendering system. Hence, improvement on the transparency feature of the e-Tendering system was required to reduce the occurrence of bribery.

**Objective 3:** To identify and rank the potential initiatives for improvement

For achieving this objective, similar to the first and second parts of survey, we performed the reliability analysis by using Cronbach's Alpha. As can be seen in Table 10, the data collected in Part 3 provided a value of 0.914 for Cronbach's Alpha Index. The result was shown in Table 10 and it had exceeded the desired value of 0.70, which proved that the data collected in this part was consistent in its scale. This concluded that this set of data was reliable as it was found with consistent scale.

*Table 10. Reliability Analysis For Potential Initiatives*

| Reliability Statistics | | |
|---|---|---|
| **Cronbach's Alpha** | **Cronbach's Alpha Based on Standardized Items** | **N of Items** |
| 0.914 | 0.920 | 9 |

In addition, similar to the analysis for the second objective, for the third objective TOPSIS was applied as well in order to identify the significance for the effectiveness of the proposed initiatives. Following the steps of TOPSIS introduced in Section 4, the ranks of potential initiatives to enhance e-tendering process could be obtained which the result is presented in Table 11.

*Table 11. TOPSIS Results For Potential Initiatives To Enhance E-Tendering Process.*

| $\frac{D(S_i^-)}{D(S_i^+)+D(S_i^-)}$ | Parameter No. | Rank |
|---|---|---|
| 0.33221 | P2 | 1 |
| 0.33221 | P3 | 1 |
| 0.33221 | P4 | 1 |
| 0.31182 | P1 | 2 |
| 0.31182 | P6 | 2 |
| 0.31182 | P7 | 2 |
| 0.24323 | P5 | 3 |
| 0.22764 | P8 | 4 |
| 0.21245 | P9 | 5 |

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The initiatives that were ranked in the first place among the 9 initiatives were P2, P3 and P4. P2 stated that report of award proceeding must be provided by e-Tendering system, whereas, P3 stated that the condition of the winning bid should be provided by e-Tendering system. These two initiatives were proposed in order to enhance the feature of the e-Tendering system and reduce the risk of corruption.

On the other hand, P4, which was ranked in first place as well, stated that professional training should be provided to the tendering authorities in order to process the tenders according to the Code of ethic. As mentioned by professional in construction industry, corruption can be anywhere. It doesn't matter if e-Tendering system or the conventional method was applied. Bribery will always look for opportunity to influence the person in charge by offering rewards. Thereby, it is important to enhance individual integrity of the tendering authorities, so that the evaluation was performed according to the Code of ethic.

The initiatives that were ranked in the second place were P1, P6 and P7. The respondents agreed that it was important to disclose the information of the entire handling process to the public. This was known to be effective in reducing the risk of corruption because everyone had the right to monitor the entire process. This eventually reduces the risk of corruption as it was difficult for the tendering authority to do final decision which was not reasonably meeting the criteria of the procurement. Thus, disclosure for the information of the entire handling process was agreed by the respondent which able to reduce the opportunity for corruption.

P6 and P7 were proposed in order to enhance the integrity of the construction organization. P6 stated that ethical atmosphere of an organization should be established according to the Code of ethic practiced by the professional bodies. This is essential in order to enhance the individual integrity of the contractor, so that the contractor will avoid unethical behaviour as Code of Ethic is practised. Besides that, P7 suggested that top management should be the role model for resisting unethical behaviour. This was known to be essential as top management is the leader of an organization. If the leader acts unethically, the subordinate will follow the leader's action as well. Thus, the respondents were agreed with that top management plays key role in reducing corruption by enhancing the ethical atmosphere of an organization and as a role model in rejecting unethical behaviour.

P5 stated that meritocracy system was required in selecting e-Tendering administration in order to reduce risk of corruption. It was ranked in the third place, which was an essential aspect to be look into. This system was suggested in order to select proper tendering authorities who hold the Code of Ethic and strong individual integrity. As an English quote stated that "you can't clap with one hand". This showed that if the tendering authorities strongly resist with unethical behaviour, then corruption will not occur as the contractor who bid the tender do not have the opportunity for undue influence towards the authorities. Hence, P5 was able to reduce the risk of corruption and the respondents were agreed with this statement.

P8, which stated judiciary bodies should not be controlled by the politicians, was ranked in the fourth ranked and followed by P9, which stated that law enhancement is required in assisting judiciary bodies in investigation, in the fifth rank. These two initiatives were interrelated as the judiciary bodies should be able to perform investigation without the interference of the politicians and with the assists of law. As the judiciary bodies were able to perform investigation without limitation from the politicians or law, reduction of corruption risk was able to achieve. This is because when the judiciary bodies have the power to perform investigation on reported cases, the intention for undue influence cautious and thereby the rate of corruption is reduced.

## 6. LIMITATION AND RECOMMENDATION

This study is considered as new topic in Malaysian construction industry as there is not much research related to this topic. Although the results showed from this study was desired, still it is believed that unethical issues in this area are more serious than the results obtained as it is difficult to dig the truth out of the earth. This is due to the personality of the human which is more conservative and les civilized. Besides that, time constraint had limited this study in obtaining more data in order to produce better results. However, this study may provide a framework for the real situation of e-Tendering process for future study and fundamental knowledge for the improvement of current practice in construction industry.

The focus of this research is mainly on ethical issues that involves in electronic procurement system based on construction procurement process with the identification of the factors behind the phenomena and general suggestions for future improvement by construction organizations. It is

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recommended that in future study, the researchers should focus more towards the following issues:

Increase or maximize the profits of an organization towards both short-term and long-term profitability by utilizing ethical behaviors;

Develop high productivity within organizations or industry with the consideration of factors and processes to produce quality products and services by taking ethical factors into account;

Preserve or maximize the wealth of every parties involved in construction procurement by applying ethical method;

In summary, the findings from the discussion performed had achieved the objectives of this study. The data analysis for Part 1 had illustrated the existing situation of e-Tendering with several situations related to ethical issues provided. This had achieved the first objective of this study. Besides that, Part 2 had highlighted the factors that contributed to ethical issue in e-Tendering. The significance of the factors was identified as well. This had achieved the second objective of this study. Lastly, Part 3 had achieved the third objective by identify the initiatives that were proposed in order to enhance the current situation of e-Tendering.

## 7. CONCLUSION

Therefore, this study had determined the existing situation of the current e-Tendering related to ethical issue in Malaysia construction industry. Besides that, it also figured out the factors that contributed to ethical issue that involved in e-Tendering process. Potential initiatives were proposed in this study to enhance the performance of e-Tendering process in order to produce a better quality of results. These results had achieved the objectives of this study. The application of e-Tendering system able to reduce the rate of corruption with the improvement suggested in this study. From the analysis results obtained by TOPSIS, it was concluded that the most critical factor that contributed to the ethical issue in e-Tendering was cronyism, followed by lack of meritocracy, collusion, unpublicized process, long-term relationship, human greed and transparency feature of e-Tendering. In addition, from the result, it was concluded that the initiative that was known to be most potential in enhancing e-Tendering process was the features of the e-Tendering system and the ethical awareness among tendering authorities.

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